DRAVO REVIEW

SPRING, 1977

DRAVO REVIEW SPRING 1977

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In this issue

The covers

Front—This 300 million-year-old piece of limestone saw the dinosaurs come and go. Now it is being used to clean up the air. (See story at right.)

Back—Crushed limestone feeds into three rotary kilns at the new Maysville, Ky., processing facility, built to produce Dravo's patented *Thiosorbic®* lime.

Borrowing from the past to clean-up the future

Lime is anything but a new product. Layers of limestone were forming in the earth's crust 300 million years before the last dinosaur walked the earth—and that was about 70 million years ago. Some of the recorded history of the earth is contained in limestone, as most of it is of organic origin and represents the calcareous remains of small plants and animals, usually salt-water organisms. In the days of the dinosaurs, air pollution wasn't a problem and limestone wasn't yet named. But the deposits that were forming are now becoming an important resource for cleaner air.

Limestone, after it is mined and calcined, produces lime, a much-needed chemical reagent which reduces sulfur dioxide in the emissions from coal-burning electric powerplants. There are many kinds of limestone, with differing chemical analyses which will produce different types of lime.

The qualities of lime to be used in sulfur dioxide control systems were given little thought until Dravo researchers produced a better lime. *Thiosorbic®* lime, as it was named, was developed after extensive research and experimentation into the chemistry of desulfurization of powerplant stack gases through the process of wet scrubbing. Researchers discovered that lime of certain magnesium content is a more efficient agent for stack gas scrubbing than conventional lime.

Thiosorbic lime operates on the principle that magnesium sulfite, bicarbonite and carbonate are much more soluble than the calcium equivalents and can produce a solution with high dissolved alkalinity. A balanced amount of magnesium oxide is present in *Thiosorbic* lime to promote greatly increased scrubbing efficiency.

Scrubbing with ordinary commercially available lime produces a scale-like gypsum which builds up in the scrubbing equipment and requires extensive downtime for cleaning. During test runs with

Right — *Nearly a thousand feet below the ground's surface, miners use the most modern equipment to extract rock from the 35-foot thick limestone seam. The photographer's lens brings color to the normally grey-walled cavern.*

the *Thiosorbic* lime, not only was there no scaling, but the scrubbing solution removed some of the scale left in the scrubber from previous runs on ordinary lime. Pilot plant experiences confirmed the theoretical predictions that a magnesium sulfite solution prevents the formation of scale. Testing was done at pilot and full-scale scrubber operations with actual boiler operating conditions.

Being a more efficient scrubbing medium, less *Thiosorbic* lime is required, compared with limestone. Substantial savings can be realized in lower lime tonnage being purchased, transported and handled.

Dravo owns proprietary rights to the use of this type of lime and is marketing the material under long-term contracts to a number of electric utility companies. A subsidiary, Dravo Lime Company, was formed to produce *Thiosorbic* lime and is the first company to be developed primarily to serve the new large lime demand of the electric utility companies. This facility will also provide lime for metallurgical use by steel companies.

Large demands for lime mean Dravo Lime will soon be supplying one million tons of *Thiosorbic* lime per year from the company's new $60-million mine and processing plant at Maysville, Ky. The mine, having a 35-foot-thick seam, is designed to produce a nominal 2.7 million tons per year of raw limestone with an initial daily lime production of 3,000 tons. Construction of the facility began in 1974 on an 80-acre site along the Ohio River, after numerous limestone deposits throughout the country had been geologically and chemically evaluated to determine the best location for large quantities of lime with the proper chemical characteristics. Exploration has proven the existence of sufficient recoverable reserves to support operations for over 50 years.

The engineering and construction of the plant was performed by Dravo itself, as will be the shipment of lime, by barge, to utilities.

To develop the limestone deposit, both vertical and inclined shafts were sunk 950 feet below the surface. Stone for processing is mined by drilling and blasting. The mine is the first in the country to use all-hydraulic drilling. After primary crushing, limestone is brought to the surface on a high-speed 3,000-foot-long, 18-degree-slope conveyor system before undergoing a second crushing and sizing operation. The rock is fed to three rotary kilns designed to produce a highly reactive soft-burned product. The 203-foot-long kilns are the largest of their kind in the world. Each is rated at 1,000 tons per day.

Thiosorbic lime is then shipped to the utility plants primarily by river barge, with additional rail and truck facilities available.

The annual capacity of the processing

Right—*After being mined, the limestone undergoes primary crushing within the mine, followed by a second sizing and crushing operation above ground. Here workmen inspect rock on its way to the kilns in background.*


Dravo
Lime

facilities is over 75 per cent sold. With additional supply contracts under negotiation, a first-step expansion of the plant will be considered some time this year.

The Maysville facility employs approximately 150 people in limestone mining, crushing and calcining. It is the largest single capital investment undertaken to date by Dravo in its 86-year history.

Another Dravo-developed substance, *Calcilox*® stabilizing agent, has been proven effective for stabilization of the sludge into an earth-like substance. *Calcilox* stabilizing agent was developed to permit disposal of scrubber waste in an environmentally acceptable manner.

Dravo Lime also can supply utilities with engineering and design services for systems for disposing of the sludge that results from scrubbing.

Above—Thiosorbic *lime is used in SO_2 scrubber units, like the ones pictured at the coal-fired Phillips power station of Duquesne Light Company near South Heights, Pa.*

Right—*The morning sun lights up the three rotary kilns at Maysville. Each is 203-feet long, the largest of their kind in the world.*

BEFORE THE FACT

Model making has proven an effective technique in reducing engineering costs, producing a better engineered plant and aiding construction at the jobsite. About 20 years ago Dravo's Chemical Plants Division set up a model shop to produce models "before" a plant was built, rather than "after the fact." By making a model during the design stages and before the working drawings, Dravo, its clients and subcontractors have saved many thousands of dollars and uncountable working hours on each of many projects.

Although Dravo didn't originate this idea, it has been a pioneer in engineering model-making techniques. Models have been used as far back as 5,000 BC, as evidenced by model ships found in Egyptian tombs. As ship design became more sophisticated, the models became more elaborate and a more important communication tool in the construction of vessels. Elaborate testing and proving procedures are accomplished by way of some models, and better design requirements can be incorporated before the final construction of a project.

Industrial applications of model-making are seen more and more in the design and construction of complex chemical and petrochemical plants, refineries and powerplants, particularly those projects where a great quantity of piping is used. Dravo has proved that scale models—concerned primarily with piping systems and how they fit into the entire plant layout — can save costly mistakes in construction, influence selection of construction materials and help construction supervisors estimate accurately the size of the labor force. Interpreting drawings at the site often brings up questions which are easily answered by a visual examination.

There are two stages to model-making, a preliminary layout model and a final design model. The layout stage begins after engineers have established the process. Designers then go to work using blocks and cylinders, representing equipment and vessels, which can easily be changed.

Once an acceptable plant layout is designed, the model can be further revised by engineering specialists and by the client to produce the near perfect layout. Following the preliminary layout model, a final design model is begun. On the final model all the piping is put into place, as well as heating, ventilating and air conditioning equipment and electrical conduit and instrumentation.

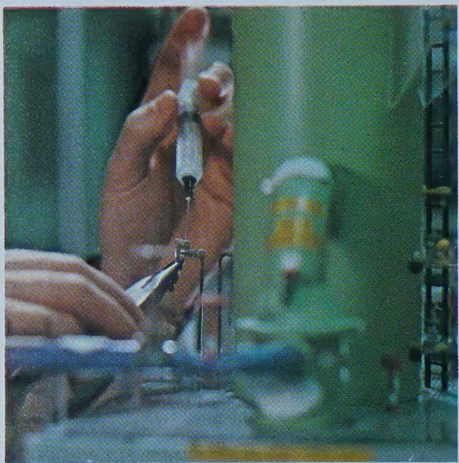
Building models eliminates the need for orthographic piping drawings, significant since a medium-sized plant may require as many as 80 such drawings. Construction interferences resulting from misplaced items on drawings have been reduced from 30 per cent to two per cent by use of the model. A three-dimensional, color-coordinated model makes it impossible to put two things in the same place. The visibility of the design model encourages input from designers, supervisors, operators and clients at a time when changes, improvements and corrections are relatively easy and inexpensive to make.

The model is constructed accurately to scale and includes every space-consuming item. On the final design model, lines can be reviewed to control the number of twists and turns, reducing elbow, piping and pumping costs. Hydraulics are also more easily reviewed on a piping model than on drawings. Piping runs can be reviewed to reduce the runs of alloy and other expensive materials resulting in lower piping material costs.

The model is a true engineering tool and not a display model. Detail is not important on the final design model, but placement of equipment is critical. Once the final design model is completed, isometric drawings of each line are then made for construction of the plant. Dravo now has a computer program for producing these isometric drawings on a computerized plotter. This technique can reduce drafting work for piping isometrics by as much as 40 per cent.

Model-building is not inexpensive; however, the cost is usually less or comparable to the cost of the orthographic drawings that it replaces.

One company using the model technique reported eliminating $50,000 worth of piping and fittings, while the model cost only $20,000 to produce. Further savings are realized by the fact that design drawings of the other disciplines—structural, HVAC, electrical and instrumentation—are virtually void of interferences, since the model is a total coordinating effort. Dravo has discovered that model construction can



Above — *Unlike actual construction where pipes are welded and handled with heavy equipment, the model-maker uses a syringe for glueing and needle-nosed pliers to maneuver small parts into place.*

also provide better and quicker designs for less engineering costs, reduce plant maintenance and reduce the time required to design and build plants. Subcontractors have been known to submit lower bids on a job where a model is available.

In addition to model-making, our model shop has been used as a creative training ground for piping design drafters and engineers through a combination of on-the-job training and night school classes. They work with a complete line of supplies, materials and tools available for this particular craft.

As more and more engineering and construction firms as well as operating companies employ the engineering model technique, the professionalism of the engineers and technicians involved in engineering models is being promoted by a society dedicated to that end, the American Engineering Model Society. This group holds annual seminars which are attended by engineers from the U.S. and other countries. As the need grows for improved communication, some junior colleges now offer courses to train model technicians.

By the building of miniature plants, everyone wins. The customer gets a better designed plant in less time. The engineer has more flexibility in producing a plant that costs less; and contractors' costs are reduced through elimination of drawing error and the time required to interpret drawings. Model-making turns three-dimensional planning into more effective communication.

Right—*Different models are under construction at the same time, giving an assembly-line appearance to the model shop. Large models may be built in sections on multiple tables which link together to form the complete model.*

From deserts to tropical jungles, above and below the sea, to the highest of mountain ranges and even the frozen Arctic, Dravo Van Houten, Inc. has been there.

This engineering organization, previously Van Houten Associates, Inc., was acquired last summer as a Dravo subsidiary. The firm is recognized worldwide for its marine engineering services to the oil and gas industry, port and harbor authorities, and a variety of industrial and governmental enterprises. Typical projects include marine facilities, production platforms, pipelines, mooring facilities, and port and harbor development.

The New York-based firm, founded 11 years ago, has a staff of civil, structural, mechanical and electrical engineers, of which a number specialize in such fields as soils, coastal and hydraulic engineering, research and development, and planning. Designers, estimators, specification writers, construction managers and draftsmen round out the operation.

During their professional careers the firm's personnel have been exposed to most of the world's geographical, climatic and environmental barriers. Their expertise is well-tested on a project such as a single-point mooring facility, located in 295 feet of water fifty miles off the coast of Eastern Malaysia.

About 80 per cent of Dravo Van Houten's work has been for overseas clients. Its personnel have worked in nearly 50 countries in the Middle East, Far East, Africa, Europe, and North, South and Central America. They have performed master planning studies, feasibility studies and site investigations, economic studies, model testing, preliminary and final design engineering, training programs and a wide range of management functions.

The firm is able to maintain a certain "personal touch" in its work. Each project is managed by one of the Dravo Van Houten officers, with detailed supervision by a senior staff member acting as project manager. A technical committee, made up of officers, regularly reviews the progress of each assignment in terms of cost, maintenance, operation and impact on the environment.

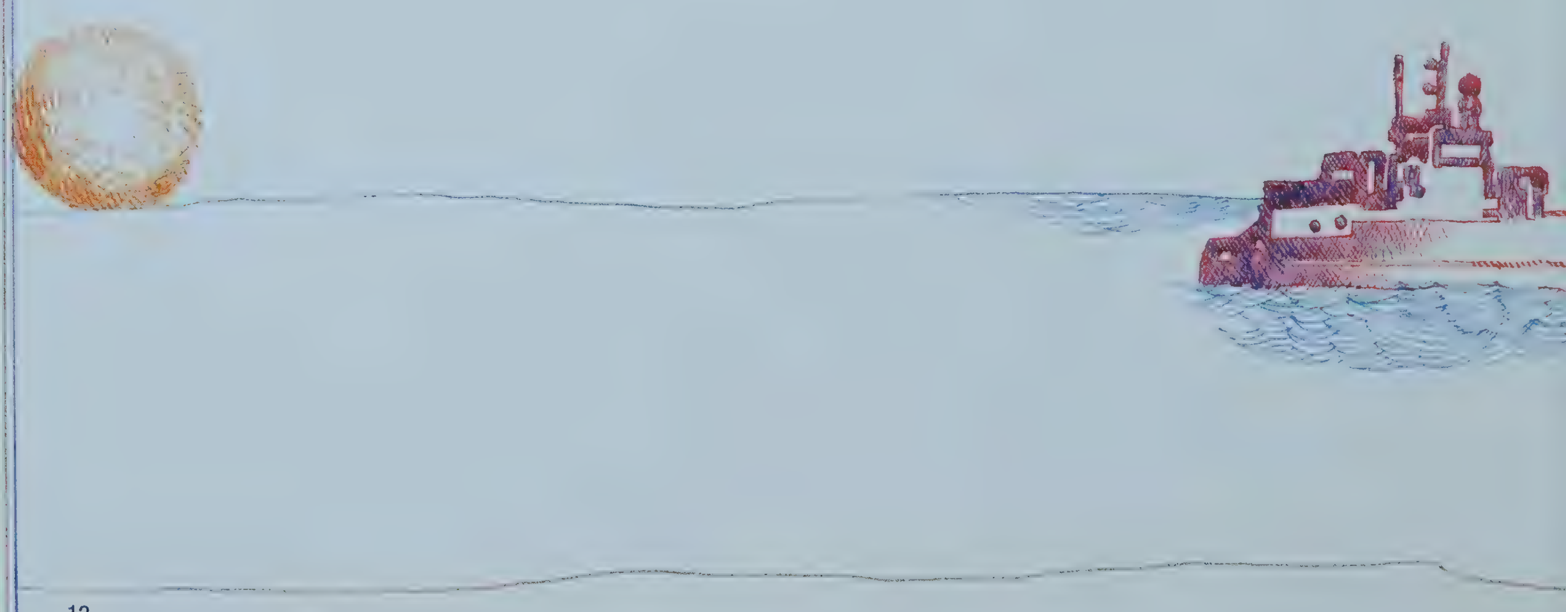
Ports and harbors represent one of the major fields of activity. Typical of marine crude oil terminal projects on which the firm has worked is the installation at Kharg Island, Iran, the largest of its type in the world. Not only were the firm's key personnel responsible for the planning of the terminal facilities, but the company also engineered the storage and associated facilities which include 1,000,000-barrel tanks, which at that time were the largest ever built. A file photo of Kharg Island shows a soccer match being held within a 360-foot-diameter crude oil storage tank under construction. The match was held in honor of a site visit by the Shah of Iran.

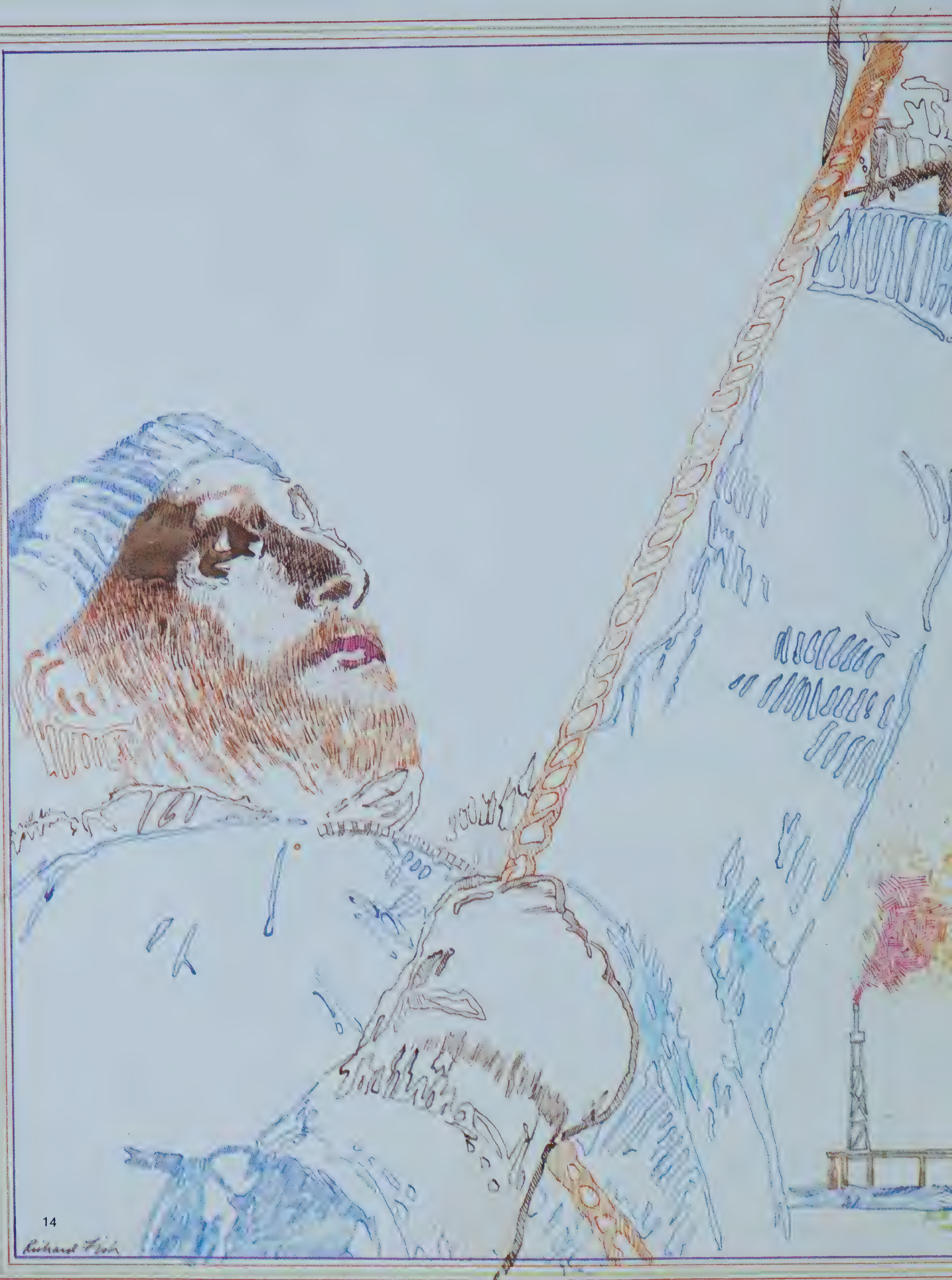
The Iran job, the firm's largest continuous assignment which ran more than six years in design, was another opportunity for Dravo Van Houten to demonstrate why it has been recognized as a leader in reduction of oil storage costs. The firm has pioneered in the engineering and use of large storage tanks. It is expert in sizing, locating and arranging tank farms on all kinds of foundations and in preparing specifications for fabrication and erection.

At Batangas Bay, Philippines, the firm had responsibility for feasibility studies for a new facility designed to accommodate 250,000-deadweight-ton tankers. They are not the largest ships, but the terminal was to be located in deep water and required gathering data on soils, waves and weather.

Topographic, hydrographic and me-

Around the world in 11 years




Richard Fish

teorological surveys are an integral part of the organization's preparation for designing offshore and port facilities. Often model testing and research is done to ensure the project performs the function for which it was commissioned. For instance, model studies on a harbor would be conducted to determine the optimum layout for breakwaters, berths and supporting facilities.

Even operations studies are taken into account for new projects. When a supertanker terminal on the Atlantic Coast, north of Cape Charles, was under design, traffic studies were included to establish annual costs of tanker waiting times.

Economic studies are also done by Dravo Van Houten. One major study was carried out to develop a long range terminal expansion program in which the report conclusions set forth the optimum storage capacity, loading rates and number of supertanker berths required for each stage of expansion.

In the area of training, the firm had a color-coded scale model prepared of a complex semi-automated product loading manifold, capable of handling up to 25 different refinery products as well as feedstock and ballast water loading and unloading pipelines. Such models are often used to familiarize and train company personnel in operating procedures of a complex project.

Oil and gas aren't Dravo Van Houten's only areas of experience. A port facility might require designing a system for discharging liquid ammonia from refrigerated ships in Costa Rica, or loading liquid chlorine at −35 degrees Fahrenheit in Brazil. In Bolivia, running a 24-inch high pressure natural gas pipeline 500 kilometers long, including 12 major river crossings, was handled by designing pipeline suspension bridges. Another such bridge, over 6,500 feet in length, was designed to cross the Rio Grande River.

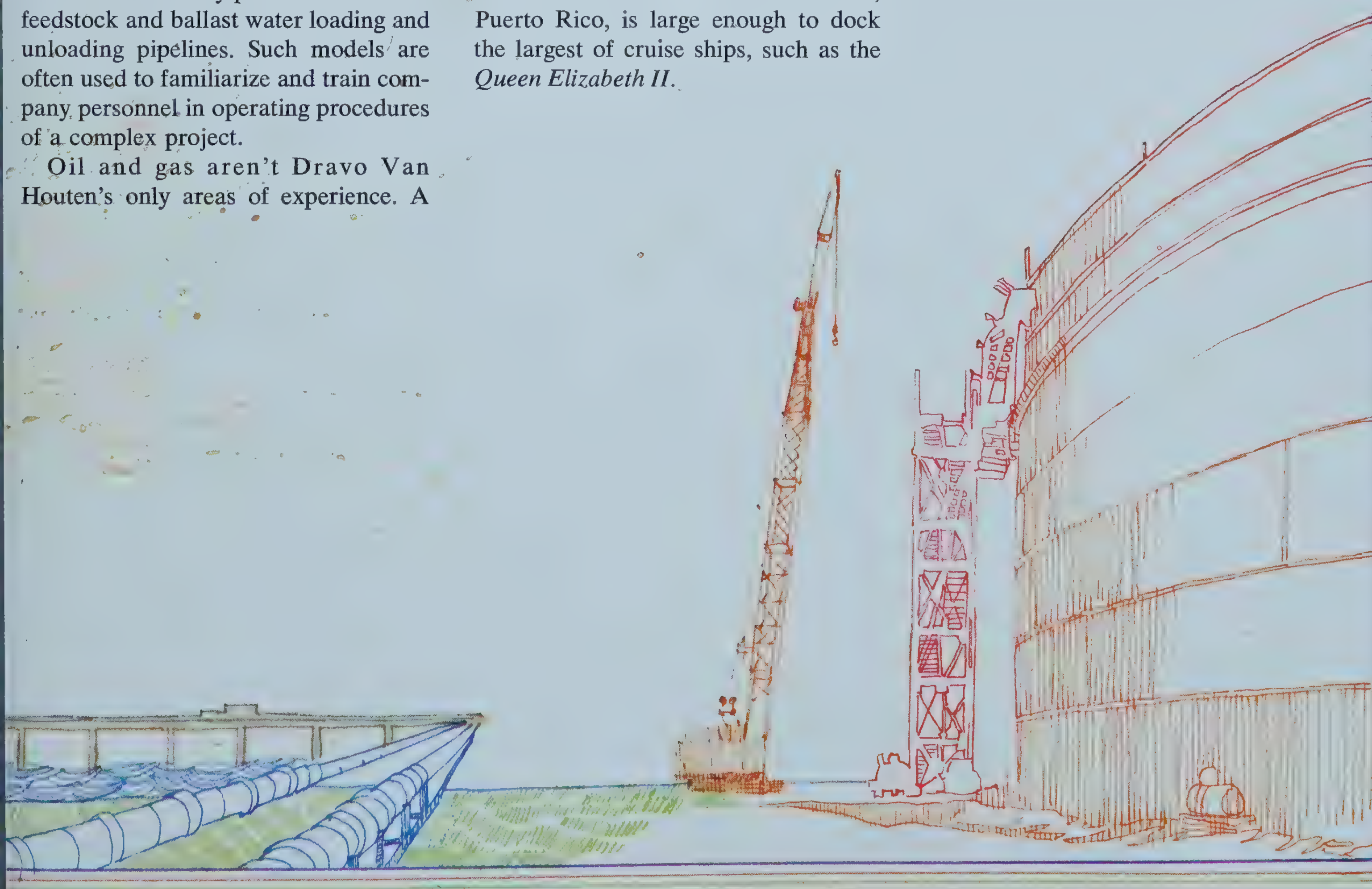
On occasion, other civil engineering capabilities are brought into focus, particularly when the oil and gas industry is presented with the problem of developing virgin territory, in a difficult climate, into a bustling supportive community. Dravo Van Houten is capable of engineering complete town sites with water supply, sewage disposal, roads, street lights, and other utilities, as well as designing housing, offices, schools and hospitals. And all the work must maintain an environment which the employees and dependents are prepared to accept for their new home.

Cruise ship terminals and recreational marinas are other facets of the firm's business. One terminal in San Juan, Puerto Rico, is large enough to dock the largest of cruise ships, such as the *Queen Elizabeth II*.

Current U.S. projects include the Elk Hills petroleum reserve, where facilities for the U.S. Navy are underway; and a study for the Department of Transportation for the safety of offshore pipelines. Also, for the Federal Energy Administration, a study has been carried out related to the proposed strategic petroleum storage facilities.

Numerous port pollution studies have been conducted. One, for the Navy, explored oil spill containment and recovery.

Dravo Van Houten, having designed over 400 projects, significantly expands Dravo's participation in marine engineering services to the oil and gas industry and to domestic and international port operators. The subsidiary's capabilities were well recognized when the U.S. Maritime Administration commissioned a 25-year future study of the U.S. and worldwide development of offshore oil and gas; near-shore and deep-ocean mining; marine energy sites and sources; and marine service platforms and artificial islands. The focus was on the relationship and impact of the latter activities on the maritime industry.



THE LAST MILE

The two-engined train left East Pittsburgh with a seven-man crew and a single piece of freight to begin the more than 600 mile trip to Moscow, Ohio. The cargo, a 462-ton generator stator built by the Large Rotating Apparatus Division of Westinghouse Electric Corporation, was being moved on a specially-built Schnabel rail car for installation at Cincinnati Gas & Electric Co.'s William H. Zimmer nuclear power station on the Ohio River.

Conrail delivered the train to Cincinnati where the Chesapeake & Ohio Railroad picked it up for the next leg of the trip to Ivor, Ky. Hours out of Cincinnati the diesel locomotives were shut down after the train came to the end of its track, a specially-built rail spur ending on the shore of the Ohio.

There was one mile yet to go before anyone could say "home free." The powerplant's cooling tower was easily visible above the trees on the opposite shore.

The last mile was negotiated through use of a "floating bridge"—a 200-foot-long heavy duty deck barge supplied by Union Mechling Corporation, a Dravo subsidiary. The transportation of heavy generators by river barge is a common practice, but in this instance the entire rail car and stator—a load totaling 759 tons—had to be moved across on the barge.

Welding a set of rails onto the deck of the barge was the innovative approach worked out through the combined efforts of Westinghouse; Kaiser Engineering, the general contractor for the move; Cincinnati Gas & Electric; Union Mechling and Carlisle Construction Co., which provided local labor and equipment.

The massive Union Mechling barge was docked tightly at a specially-built barge slip. Hatches were opened and the barge was flooded so its bottom came to rest firmly on a 12-inch sand buffer over two concrete supports.

The welding began. Over 400 lineal feet of rail were attached to plates and welded to the barge deck. The rail, alone, bridged the few inches between barge and edge of the slip, making the barge an extension of the rail spur.

With slow deliberate grace the car was eased onto the barge. Steel cables lashed the car and stator to the barge. The hatches were closed and pump switches thrown to begin the eight-hour deballasting process. The final section of bridging track was removed as the *Griffin C*, a 580 horsepower towboat coincidentally built by Dravo, moved forward on the river to pick up its cargo.

The *Griffin C* first pulled the barge from the slip before pushing it across the Ohio toward a docking site below the power station. Concerned eyes watched for any rolling motion of the barge and cargo. Careful calculations were made in advance to determine the center of gravity of the rail car, stator and barge to assure the load's stability.

An hour passed from the time the move began until the barge was maneuvered into a slip across the river and there secured. The same rails which bridged the barge and slip at Ivor, Ky., were welded into place at Moscow, Ohio.

The trip wasn't over yet. Some 4,000 feet of rail lay between the plant and the shore, and no engine on the Ohio

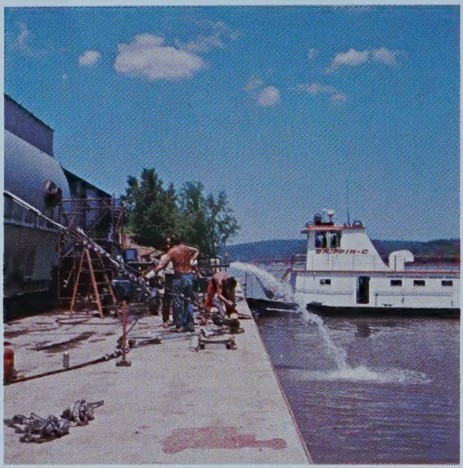
side to move the stator car. A specially-built hoist welded onto a self-propelled, flatbed rail car was used to winch the stator up the two per cent grade, having to maneuver the load around three 16-degree curves before finally arriving at the turbine building.

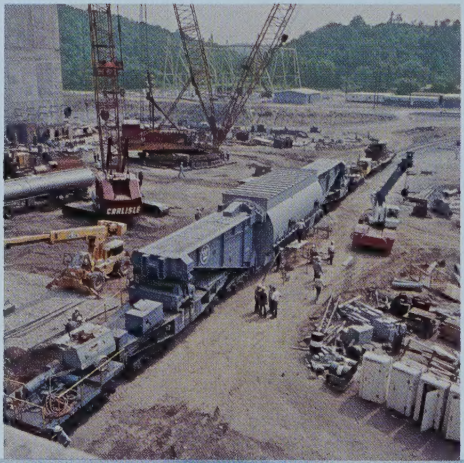
Only 30 feet from its final resting place the stator, with the aid of a 600-ton overhead crane, was lifted 100 feet into the air, rotated 90 degrees, and placed into the second story pit of the turbine building.

Seven days had passed from that first gentle push of the car onto the barge, until the final placement of the stator onto its concrete base.

But the job wasn't over. The 44-wheeled rail car sat in two pieces, no longer held together by the stator. The halves were connected and eased back down the grade for the return trip across the river, and ultimate trip back to the Westinghouse East Pittsburgh Plant.

Once wasn't enough—they ran the last mile three more times until all four component parts were in place at the new Zimmer station.

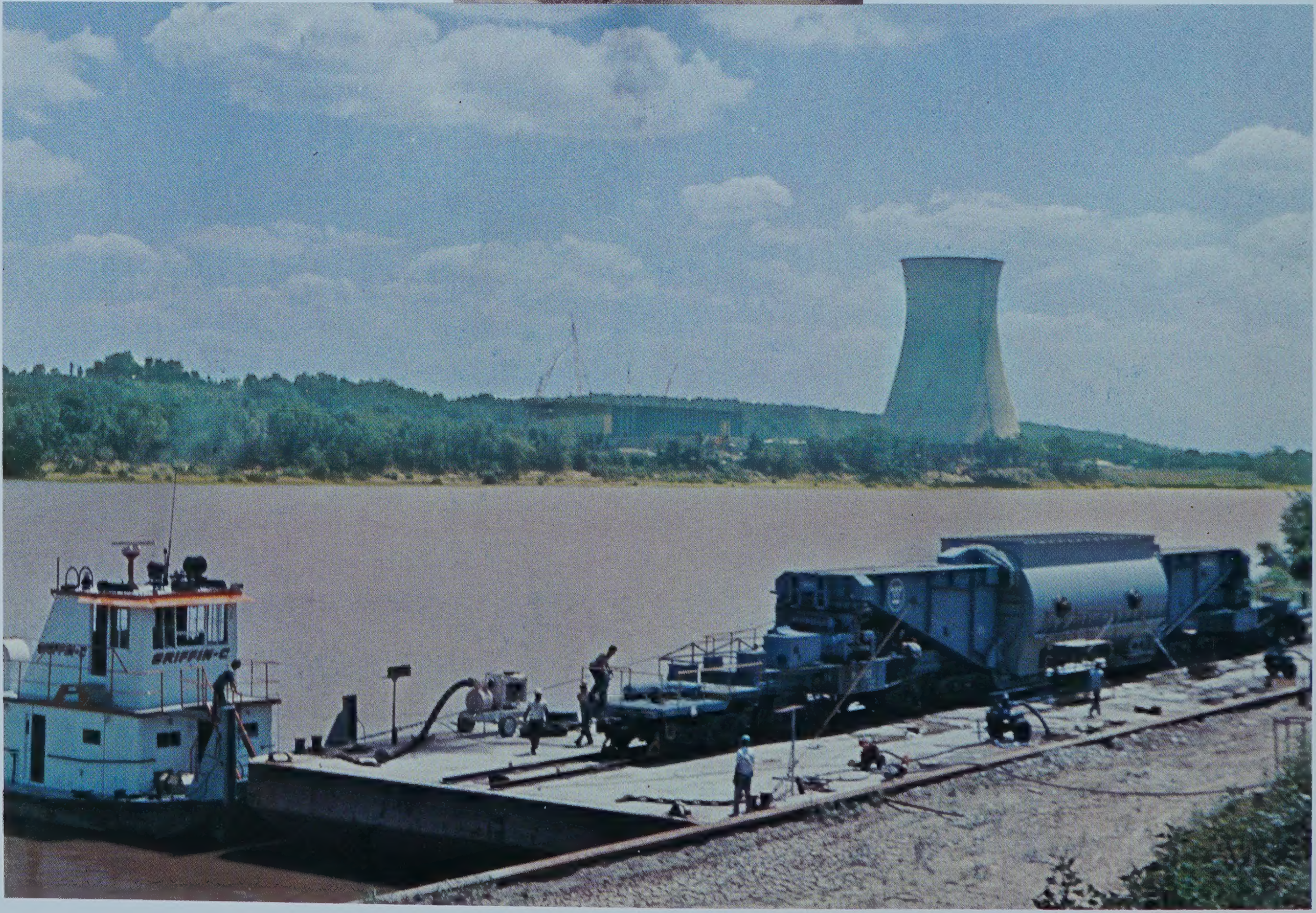




Above—*While workmen secure heavy steel cables which lash the car onto the barge, an eight-hour deballasting of the half-sunken barge begins.*

Left—*A winch car pulled the stator and car up the 2 per cent grade from the river bank to the plant. Heavy cranes then lifted the 462-ton piece into place.*

Below—*The stator and car are pushed onto the stationary barge on which rails have been welded. The cooling tower of the plant is visible in the background, just one mile from the near shore.*



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Engineering and construction services

Dravo Manufacturing Ltd.

General Offices: 701 Evans Avenue, Etobicoke, Ontario, Canada; Telephone: 416 621-7360; Offices: Montreal, Niagara Falls

Industrial and commercial space, make-up air and process heating units, ventilating units and combination heating and air conditioning units

EMP-Projetos, Comercio e Industria Ltda.

General Offices: Rue Tupis 435, 30.000 Belo Horizonte, M.G., Brazil; Telephone: 232-3431

Design and construction of plants for minerals and metals processing, food processing and other industrial processes

Societa Impianti Industriali, S.p.A. (SOIMI)

General Offices: Via Stilicone, 39, Milan 20154, Italy; Telephone: 31.78.51

Mechanical construction services

ALREM (Societe Algerienne de Realizations et D'Etudes Minieres)

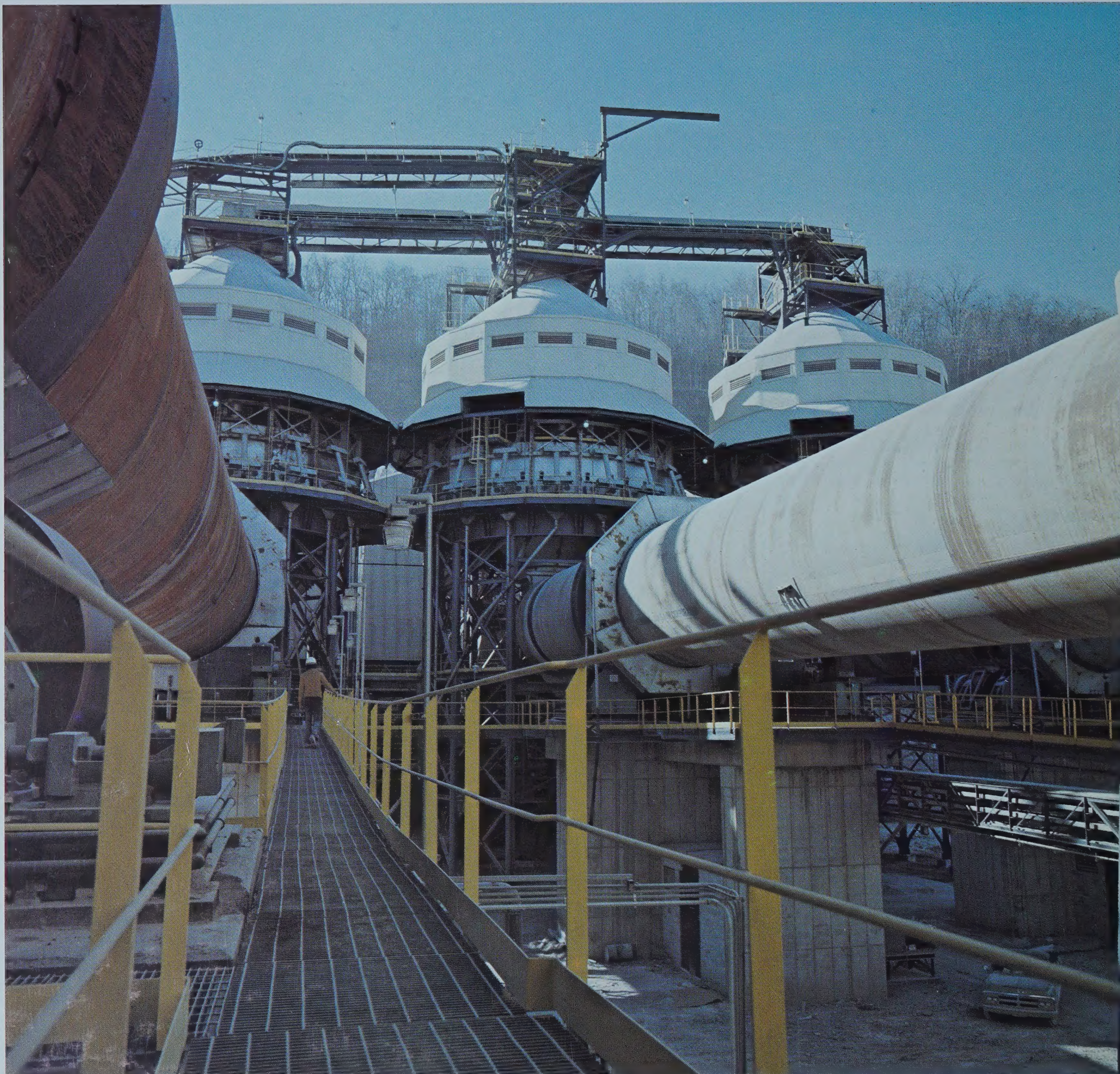
General Offices: 4/6 Boulevard Mohamed V, Algiers, Algeria; Telephone: 64.56.56

Mine development and construction of minerals processing facilities

Sanvas-Dravo Comercio e Industria de Equipamentos Ltda.

General Offices: Rua Almirante Barroso 63, Sala 205, Rio de Janeiro, R.J., Brazil; Telephone: 231-9835

Bulk materials handling equipment and systems



Dravo

Neville Island, Pittsburgh, Pa. 15225

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